

SOCIAL TRENDS IN THE DEVELOPMENT OF MODERN SCIENCE AT THE PERIPHERY: AN APPROACH TO COMPARATIVE STUDIES

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Brazil and the former British colonies share the circumstance of being, historically, at the periphery of the development of modern science. The British colonies - Australia, Canada, India, New Zealand, and the United States - were strongly dependent upon the scientific community in London, mostly centered around the Royal Society, and later upon the colonial administration. This pattern of heteronomy also meant close contacts with one of the leading centers of science in the eighteenth and nineteenth centuries in the fields of natural history - that is, botanics, zoology and geological studies.

Brazil, dependent upon an European country which had never been close to the intellectual and cultural changes which swept Europe since the Reform and the Renaissance, had little to show in terms of scientific development in the Nineteenth Century, even in a Colonial way. Early in the century the King of Portugal, D. João VI, comes to Brazil fleeing from Napoleon, and establishes the first professional schools in the country - Medicine, Engineering (first as a military school) and a few institutions such as the Botanic Garden, a laboratory for chemistry, the Museum of Natural History and a library. Only in 1920 was a University of sorts established in the country.

If the differences are so large, does it make sense to try to compare the former British with the former Iberian colonies? It does, in the sense that it could help to understand the social forces and mechanisms that contribute to foster or hinder science development in the periphery. In fact, "common sense" knowledge ^ assumes that science develops together with technology, and that both are more or less direct responses given by the cultural and educational systems of a country to the growth demands of its industry. This was obviously not so in a few countries that were able to develop as scientific world centers without a corresponding economic expansion - such as Germany in the Nineteenth Century. It had also not been so in countries that could create a fairly good scientific milieu in more modern times, in spite of remaining at the periphery of the world's economic, scientific and technological centers - such as the British Colonies, Japan, India and China.

A closer look at the Brazilian history of contemporary of science shows that it has been the end product of a few well-identified social trends. First, there were the professional schools created by the Portuguese King from 1808 on. These professional schools inherited some of the spirit of the reform introduced at the University of Coimbra, in Lisbon, in the 1770's, in an attempt to modernize the Portuguese educational system. This reform (known as "Reforma Pombalina") was openly anti-ecclesiastic and anti-scholastic, and it led to some openness to experimental and practical knowledge that was to be later transferred to Brazil.

It is curious how the intellectual scholasticism that was dominant in the Catholic tradition was able to reborn in a disguised way in the Positivist doctrine that was to pervade the Brazilian technical and military schools in the second half of the Nineteenth Century. With this doctrine, science becomes a closed system of knowledge, orthodoxy is established and disputed, and an experimental mentality could not develop.

Medicine and engineering were thus brought closer to law as the classical laic careers in the country. They allowed for social mobility outside market activities, and provided the sons of the landed classes and administrators with education and style which could enhance their social status, and also provided a few services which were certainly needed: people who could handle a complex public bureaucracy and take care of the system of private property; people to heal or comfort the ill; and people to open roads, build houses and wage wars against internal and external enemies.

Thus, the professional schools brought some technology, but not science nor its spirit. As time went on, the country grew, resources were more available, and the demands for education were also stimulated. New professional schools were created, a few of them were brought together as "Universities", and the system expanded in size, if not always in quality. Later, in the twenties, some people started to be concerned with the need to education for the masses. They thought that the country had to enter the twenty century, and one of the ways for doing that was to expand the educational system. This corresponded, of course, to the demands for education of an emerging middle class, which could now see the path to access to the traditional professional schools. It also corresponded to the growth needs and modernizing outlooks of a new political and military elite which took control of the country after 1930, carrying with it some of the old positivistic ideology which has been preserved in the South of the country until that time.

In this way an increasingly large educational system was created. It was a pyramid that had the professional schools at the top, a secondary school with a humanistic and supposedly scientific content behind it, and three to four years primary school for the masses. At this system was planned and coordinated by a growing bureaucracy at the national level - the Ministry of Education - and at the state and local levels - the secretaries of education, which dealt mostly with the lower levels of the system,

This is thus one of the main streams of social forces that shaped the Brazilian educational system and still yields strong influence in the country's scientific life. Today, the Ministry of Education is responsible for a huge University system with about thirty universities, and is also responsible for controlling the quality of the private and local universities and independent professional schools throughout the country. This system has expanded dramatically in the last 10 years increased about tenfold. A large program of graduate training is now being implemented to increase or reestablish some of the quality that was lost in this process of growth

A second trend, much smaller in size but very significant, were the efforts to create a University centered on science schools, and not the professional ones. It is possible to trace these efforts to a group of engineers and mathematicians that were able to challenge the predominant positivistic outlook at the Polytechnic School of Rio de Janeiro, late last century. Or to some doctors at the medical school of Rio de Janeiro which started with daring experiments in surgery more or less at the same time. Contacts with France were intense, the impact of modern mathematics, which changed the positivistic dogma, came by ship, and the dramatic results obtained by Pasteur and his experimental approach to medicine were all too evident. It became obvious for some that a new kind of university has to be created. It became also dear for those in governmental positions that experimental science could do something for them. This led to a third trend of development, which will be dealt with later, after a closer look at the new University.

Propaganda towards a modern, science-oriented university was intensified In Rio de Janeiro during the twenties and thirties. It led to the notion that this University should be centered around a Faculty of Philosophy, Sciences and Letters - a non-professional unit that could carry on independent research and speculation, and influence the professional schools. As it happened, this effort clashed with the much stronger drive towards general education that had the professional schools at its apex, and the Federal Ministry of Education in the leadership. In Minas Gerais, this movement was

aborted in 1930 when personal conflicts led to Federal intervention at the local university; in Rio de Janeiro, the University of the Federal District, created around the ideas of Anísio Teixeira and Fernando de Azevedo, was short-lived, being dismantled by the Federal Government as suspected of leftist leanings. Only in São Paulo, where a strong autonomist Spirit was able to remain, was a state-based University created and implemented, around the Faculty of Philosophy model.

The experience of the University of Sao Paulo is mixed, and is still to be fully evaluated. Some facts however, are clear: this is the first and major Brazilian university until these days, it is the only major university supported by a state government, and as such independent of the Ministry of Education, and it was able to produce the main lines of scientific research which latter influenced the rest of the country. Why was Sao Paulo able to create this University system has to do with the fact that it was at the same time the richest state and the most important point of resistance to the centralization policies of Vargas government since the thirties.

In short, the University of Sao Paulo embodied what Brazil have as an attempt to create an academic tradition of research and scientific development, which attracted the best scientific vocations in the country, and acted as the second pole around which the scientific and educational development of Brazil occurred.

These two trends towards education and science led to these goals for their own worth, on the assumption that they would be also good for social development modernization, secularization of society, and so on. At the same time, however, some demands upon modern technology were being articulated by the public sector, creating a third trend in the same direction.

The first outstanding landmark in this line was the fight against the yellow fever and other infectious diseases in the beginning of this century. Created on the Pasteur institute model, the Institute Manguinhos of Rio de Janeiro was extremely successful in controlling the disease, and also in securing governmental funds for organizing a full-fledged research center in tropical medicine.

Other governmental agencies for technological research were established by Federal and state governments at the passage of the century. An incomplete list would include the Geographic and Geologic Commission of São Paulo (1886), the Agronomic Station (later, Institute) of Campinas (1887), the Geographic and Geologic Commission of Minas Gerais (1892), the organization of the Bacteriological Institute of Sao Paulo

(1893), the organization of meteorological services at the National Observatory (1896), the Geographical and Mineralogical Service of Brazil (1907). It was not until the early fifties, however, that an agency was set to deal with the questions of technological and scientific development for the country as a whole: it was the National Research Council (CNPq),

The original intention of the National Research Council was to become a policy instrument that could provide the country with some capability in atomic technology. It was not successful in this purpose, and it became a relatively weak grant-giving agency for individual researchers and for fellowships. From the late sixties on the Brazilian National Development Bank created a fund to support technology in Brazilian enterprises, which rapidly evolved into a Federal government program to support basic science and technology at the universities and technological institutes.

To these three lines of development - the social drive towards education, the movement towards an academic university and the governmental creation of research institutions and agencies - a fourth should be added, (t Is the technological demand generated by the economic system. In fact, Brazilian industrialization was based on the adoption of technological packages, and this has been true for the Brazilian private enterprises, the foreign enterprises in the country and the state-owned institutions, in the fields of transportation, communication, energy supply, and son on. In general, technological packages seemed 'to have been always more convenient than indigenous R & D, from the short-term needs of private and public managers of efficiency-oriented institutions.

The understanding of the present state of Brazilian scientific development and its tendencies depend on an adequate consideration of these four social trends and their relative strength and goals. Each has its own institutions, its own style of work, and a different set of values. They clash with each other, they come into provisional agreements, and they try to translate their own goals and values in each other's language.

They also correspond to quite universal demands and pressures that modern society places upon science and technology, and which help to shape their scientific institutions. What differs from one country to another is the relative strength of each, which can be certainly explained by cultural, economic and historical variables. A comparative study along these lines would be most valuable to understand each

country, and to increase the more general understanding on how science develops in a modern, peripheral society. It could also lead to better appreciation of what kinds, of international cooperation could effectively and fruitfully be established between different countries, since it could help to go beyond the technological and organizational packages, and into the real forces that strive behind them.